EFFECT OF FOUR SEED PIECE SPACINGS ON ECONOMIC RETURN OF RUSSET BURBANK POTATOES

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Numerous studies on potatoes reported in scientific literature discuss the effects of seed piece spacing on total and U.S. No. 1 yields. As might be expected, the results vary depending on the variety, soil type, environment, and numerous other factors. However, few studies included an economic evaluation, and many studies were limited to only two or three years. In the study reported here, five years of data were collected and evaluated for yield and economic return on a fresh-pack basis.

PROCEDURE

The seed piece spacing study reported here was conducted at the University of Idaho Aberdeen Research and Extension Center during 1997 through 2001. Russet Burbank seed pieces averaging 2.25 ounces were planted in a Declo silt loam soil using a hand-assist two-row planter at intervals of 8, 12, 16, or 20 inches in rows spaced 36 inches apart. Seed pieces were planted in early May and the crop was harvested in late September to early October. Plots consisted of four rows 40 feet long with data taken from the center two rows. Potatoes were fertilized according to University of Idaho recommendations, and irrigated with a solid-set sprinkler to maintain available soil moisture at 65 percent or more. Plots were arranged in a randomized complete block design with six replications.

RESULTS AND DISCUSSION

Results reported here are the 1997 through 2001 five-year average. There was a significant decrease in total yield with each 4-inch increase in the seed piece spacing (Figure 1). The highest total yield was 402 cwt./acre at the 8-inch spacing and the lowest was 327 cwt./acre at the 20-inch spacing. The U.S. No. 1 yield followed a similar trend as total yield, but there was not a significant difference in U.S. No. 1 yields between the 8- and 12-inch spacing nor between the 12- and 16-inch spacing. There was no difference among the yield of U.S. No. 2 tubers harvested from the 12- 16-, and 20-inch spacing, but the 8-inch spacing produced a U.S. No. 2 yield that was significantly lower than the other three. The 8-inch seed piece spacing produced the lowest cull yield and the 20-inch spacing produced the highest, but the 20-inch spacing cull yield was not significantly different than the cull yield at the 16-inch spacing, nor was there a difference in cull yield between the 12-inch and the 16-inch spacing.

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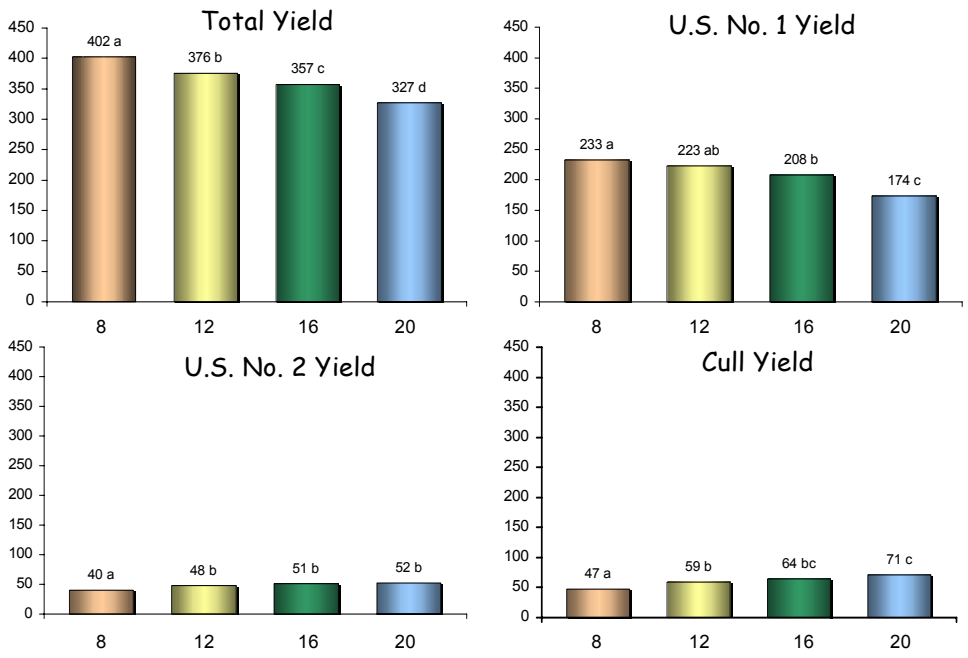

* Numbers followed by the same are not significantly different at P≤.05. Bohl and Love. 2001.

Figure 1. Yields (cwt./acre) of Russet Burbank potatoes as affected by seed piece spacing ①.

Based on yield alone, it would appear advantageous to plant Russet Burbank seed pieces at 8 inches because this spacing produced the highest total and U.S. No. 1 yields while producing the lowest yields of U.S. No. 2's and culls (Figure 1 and Table 1). However, tuber size distribution is an important factor that must also be considered when potatoes are evaluated for the fresh market. All potatoes do not have equal economic value because of size and shape differences. Table 2 shows the total yield and the percentage that graded U.S. No. 1, U.S. No. 2, or process grade quality, as well as the portion of the U.S. No. 1 yield that was packed into non-A size consumer bags or cartons. From Table 1, note that the 12-inch spacing produced the highest percent of U.S. No. 1 tubers (59.4 percent) while the 16-inch spacing produced the highest percentage of carton-size tubers (84.8 percent). Still, considering only the information in Table 2 is not sufficient to determine which seed piece spacing will provide the highest economic returns on a fresh-pack basis under the conditions assumed for this study.

Table 1. Effect of seed piece spacing on total yield and quality of Russet Burbank potatoes. The last two columns are the percent of U.S. No. 1 tubers (yield of U.S. No. 1's not shown) that packed into non-A size consumer bags and cartons, and the sum of these numbers for any seed piece spacing is equal to 100 percent, i.e., 28.7 + 71.3 = 100.

Seed Spacing	Total Yield	U.S. No. 1	U.S. No. 2	Process	Non-A	Cartons
	(Cwt./A)	% of Total Yield			% of U.S. No. 1 Yield	
8-inch	402	58.1	10.0	31.9	28.7	71.3
12-inch	376	59.4	12.6	28.0	18.6	81.4
16-inch	357	58.3	14.2	27.5	15.2	84.8
20-inch	327	53.0	15.9	31.1	28.7	71.3

One question we wanted to answer was which seed piece spacing would provide the best economic return to a grower selling potatoes on the fresh market. The economic analysis was completed using potato prices and packing costs shown in Table 2. Granted, more than one market-based economic evaluation could be completed depending on the intended market. Nevertheless, a valid comparison can be made to show the most economically beneficial seed piece spacing as long as the same parameters are consistently applied.

Table 2. Potato fresh-pack and washed process grade prices and packing costs used to calculate economic return of Russet Burbank potatoes planted at four seed piece spacings.

Cartons			Non-A Size			U.S. No. 2's		
Size	Price	Packing Cost	Size and Bag Type	Price	Packing Cost	Size	Price	Packing Cost
	$/cwt.	$/cwt.		$/cwt.	$/cwt.		$/cwt.	$/cwt.
40	14.50	4.25	10-lb. Mesh	9.50	5.00	6-10 oz.	6.50	3.25
50	16.25	4.25	10-lb. Film	8.50	4.75	> 10 oz.	8.50	3.25
60	17.25	4.25	5-lb. Mesh	11.50	6.00			
70	18.25	4.25	5-lb. Film	10.00	5.00	Washed Process Grade		
80	16.00	4.25					Price	Cost
90	14.25	4.25					$/cwt.	$/cwt.
100	13.00	4.25					1.75	1.50

The fresh-pack market economic analysis is shown in Table 3. The 16-inch seed piece spacing resulted in the highest value per hundredweight (net return to the grower) at $6.51 while the 8-inch spacing, which had the highest total yield, returned an average of $5.62/cwt., the lowest value per hundredweight in this study. The 8- and 20-inch seed piece spacings produced similar component values for non-A size tubers as did the 12- and 16-inch seed piece spacings. The carton component value followed a similar trend as the non-A size component with the 12- and 16- inch spacings having similar carton component values. As the seed piece spacing increased from 8 inches to 20 inches, the

U.S. No. 2 component of the value per hundredweight increased from $0.45 to $0.77. All seed piece spacing treatments had similar component values for processed grade tubers. Although the 16-inch seed piece spacing had the highest value per hundredweight ($6.51), the 12-inch spacing resulted in the highest gross receipts per acre at $2,372, $56 more per acre over the next highest return of $2,316 from the 16-inch seed piece spacing.

Table 3. Effect of seed piece spacing on total yield, gross receipts per acre, value per hundredweight, and component value of Russet Burbank potatoes. Value per hundredweight price shown in column 4 for each seed piece spacing is the total of the next four columns (Component Value of Return/Cwt.), e.g., .78 + 4.31 + .45+ .08 = 5.62.

Seed Spacing	Total Yield	Gross Receipts /Acre	Value /Cwt.	Non-A Size	Count Cartons	U.S. No.2 Grade	Process Grade
	(Cwt./A)	——— $ ———		Component Value of Return/Cwt. in $/Cwt.			
8-inch	402	2,257	5.62	.78	4.31	.45	.08
12-inch	376	2,372	6.32	.49	5.17	.59	.07
16-inch	357	2,316	6.51	.42	5.34	.68	.07
20-inch	327	1,851	5.66	.71	4.10	.77	.08

In as much as the 12-inch seed piece spacing resulted in the highest gross receipts per acre, decreasing the seed piece spacing means more seed planted per acre and a corresponding increase in seed costs. It takes 14,520 seed pieces to plant one acre (no skips or double-planted seed pieces) at a 12-inch spacing in rows spaced 36 inches apart, but only 10,890 seed pieces to plant one acre at a 16-inch spacing. Assuming an average seed piece size of 2.25 ounces, that's a difference of 510 pounds per acre. Does the extra seed needed for a 12-inch spacing cost more than the $56 increase in gross receipts? Or, another way to ask this question given the limitations of our analysis is, what can I spend for seed and be no worse off? To answer this second question, simply divide the additional gross receipts ($56) by 5.10 cwt. (pounds converted to cwt.), which equals $10.98 per cwt. Assuming all other costs are the same, if seed is priced more than $10.98, the narrower spacing and subsequently higher seed costs cannot be justified from an economic standpoint even with the higher gross revenue per acre.

The results of this study illustrate that seed piece spacing—plant spacing ultimately—has an impact of potato crop yield, quality and economic return. However, the purpose of this study was not to determine the "best" seed piece spacing, but to show that seed spacing needs to be tailored to match field-specific soil and environmental condition as well as the targeted market. The value placed on various quality parameters will vary by market and these market-specific quality parameters will determine price. Use a seed piece spacing along with other management practices to produce a crop tailored for the intended market. Keep the following points in mind:

- Customize your planting operation to produce the tuber size distribution and quality that returns the most value for the harvested crop based on your intended market.

- Check the accuracy of your planter frequently to ensure that the seed pieces are being planted at the spacing you want. Uncover 25 feet of row behind each planting unit, and measure the distance between each seed piece.
- Adjust seed piece spacing for soil type, for example, potatoes grown in sandy soil usually have a higher number of tubers per plant with fewer malformed, so the seed piece spacing should likely be wider.
- Modify seed piece spacing for according to growing season length, for example, potatoes grown in areas with a long growing season tend to produce larger and more malformed tubers, so the seed pieces should likely be planted at a closer spacing.